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Operation and Service Manual

325LA

43957

Broadband Power Amplifier

REV. A

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National®
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68-018
Dennison National Co.
Holyoke, MA 01041
Virgin Vinyl
Made in USA

43957

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Chapter 1

Introduction

1.1 Introduction

The ENI Model 325LA is an all solid state amplifier which has a flat frequency response from 250 kHz to 150 MHz. It provides up to 25W of linear power with low harmonic and intermodulation distortion. Gain is 50 dB nominal, with variation of less than +1.5 dB over the entire frequency range. Input and output impedance are 50Ω and the unit may be driven to full power output by most RF synthesizers, signal generators and swept signal sources.

The ENI Model 325LA will deliver its rated power output into any load impedance, regardless of match. Built-in protection circuitry will absorb the power reflected from a mismatched load without causing failure or oscillation.

Output RF voltage is displayed on the front panel meter. The Model 325LA is packaged for bench mounting and is shipping with rack mounting adapters. Its integral power supply and cooling operate from a 115 or 230 VAC 50/60 Hz main supply.

The Model 325LA will raise the power level of signal sources and generators without requiring tuning or bandswitching. The Class A linear circuitry will amplify signals of AM, FM, SSB, TV and complex modulations limited only by their peak input and bandwidth, with minimum distortion.

1.2 Specifications

Physical and electrical specifications are listed in Figure 1.

1.3 Instrument Identification

Each amplifier is identified by a serial number tag on the back panel of the unit. Both the model number and the serial number should be given in any correspondence with the company.

Chapter 2

Preparation For Use

2.1 Initial Inspection

If damage to the shipping carton is evident, request the carriers agent be present when the instrument is unpacked, Check the equipment for damage and inspect the cabinet and panel surfaces for dents and scratches.

2.2 Claim for Damage

If the Model 325LA is mechanically damaged or fails to meet specification upon receipt, notify ENI or our representative immediately. Retain the shipping carton and packing material for the carriers inspection as well as for subsequent use in returning the unit if necessary.

2.3 Mains Voltage Setting

The Supply Voltage selection switch is located at the rear of the unit and is normally set for 115VAC operation. Before connect the unit to the Mains Supply, check that the supply voltage switch is correctly set.

EXTENSIVE DAMAGE WILL RESULT IF THE AMPLIFIER IS CONNECTED TO THE WRONG SUPPLY VOLTAGE. UNDER NO CIRCUMSTANCES SHOULD THIS SWITCH BE OPERATED WHILE THE SUPPLY IS CONNECTED.

2.4 Mains Fuse Rating

MAINS FUSE RATING

The Mains Fuse F1 is located on the rear panel. The replacement part number is 313004 4ASB.

2.5 Rack Installation

In order to install the Model 325LA in a standard 19 inch relay rack, the supplied mounting brackets must be attached to the over as follows:

a. Remove the snap-on chrome caps on both ends of the cover handle.

b. Remove the four #4-40 screws and lift the handle off.

c. Remove the four feet on the underside of the amplifier if the minimum vertical usage of the relay rack is necessary.

d. Remove the two #8-32 screws located on each side of the cover nearest the front panel.

e. Attach the rack mounting brackets to the sides of the unit using the screws removed in step d.

2.6 Power Cable Ground Protection

To protect operating personnel, the ENI Model 325LA is equipped with a three conductor cable consisting of a black hot line, a white common line, and a green chassis ground. When using a two prong adapter, the green tap on the adapter must be connected to earth ground.

2.7 Cooling

When the 325LA is enclosed by an external cabinet, provisions must be made to insure an adequate flow of cooling air to the unit. Ambient temperature of the air must not exceed 40° C.

Chapter 3

Operation

3.1 Funtional Description

The ENI Model 325LA is a linear Class A amplifier capable of increasing the output of any signal generator, frequency synthesizer, sweep generator or laboratory signal source from 250 kHz to 150 MHz.

The Model 325LA is completely protected against damage due to load mismatch provided that the input RF level does not exceed 1 VRMS or 1.4V peak. If the attached signal source is capable of generating substantially more than this input voltage, please use caution in adjusting it. The Model 325LA will saturate well before the maximum input voltage and there will be no increase in output power at that point.

The 325LA is unconditionally stable. Any impedance can be connected to the input and output of the amplifier, without causing oscillation.

The 325LA will deliver its rated power to any load impedance regardless of match. Load mismatch will cause RF power to reflect back to the amplifier. The unit is designed to withstand 100% reflected power (a pure reactance open or shorr circuit load will cause 100% reflected power) continuously without damage.

An output meter is provided to indicate the average output votlage (calibrated in RMS) as well as the power output when the unit is connected to a 50Ω load. Since the meter responds only to average output, the modulation characteristics of the input signal must be taken into account when interpreting the meter readings. For example, the amplifier may be in saturation during the ON portion of a pulse yet the meter reading will be low due to the low duty cycle of the pulse input.

3.2 Control, Indicators and Connectors

FRONT AND REAR PANEL DEVICES

DEVICES	FUNCTION
POWER SWITCH	Depressing the switch "ON" connects fan and power supply to main power source.
METER	Indicates output voltage and also power for a 50Ω load. The meter circuit responds to the average RF voltage and is calibrated in RMS volts for a sine wave. The voltage pick-off is mounted directly behind the front panel at the output connector.
INPUT CONNECTOR	BNC for connection of the driving generator. Input impedance is 50Ω. Up to 1.4V peak can be supplied without causing damage; however, no additional power output can be expected past the saturation point.
OUTPUT CONNECTOR	BNC for connection of amplifier output to load.
FUSE	Holder required 3AG size, slow blow type fuse: 4ASB
LINE CORD	Three prong type plug with safety ground pin connected to cabinet.

See Figure 2 for Front and Rear panel drawings.

3.3 Operating Procedure

Refer to the following procedure as a guide to guide to operating the Model 325LA.

a. The input and output are connected via the front panel BNC connectors to the signal source and load respectively.

b. The input signal should be increased gradually while observing the output voltage on the output RF voltmeter.

c. When the Model 325LA is connected to a 50Ω load, the CW power output of the unit may be read directly from the meter scale.

d. When the amplifier is connected to an arbitrary or unknown load impedance, the following procedure will insure a low distortion power output.

   1. Disconnect the output load cable from the output BNC connector of the Model 325LA

   2. If the CW output voltage is less than 35V RMS, the unit is operating at low distortion regardless of the load impedance.

   3. Reconnect the output of the amplifier to the load.

e. If the output of the amplifier is monitored by a high frequency oscilloscope or spectrum analyzer, the input signal may be increased until the point of maximum undistorted power output is observed.

3.4 Precautions

a. The input and output of the Model 325LA should not be connected together. This will cause oscillation and may damage the input preamplifier.

b. The Model 325LA should not remain connected to an antenna when the unit is not in use. If thunderstorms are likely, it would be prudent to earth ground the unit's case.

c. When the input signal voltage of the signal source is unknown, insert an attenuator between it and the Model 325LA input.

Chapter 4

Maintenance

4.1 Initial Check

Before connecting the Model 325LA to the Mains Supply, make certain that the supply voltage switch on the rear panel is in the proper position.

EXTENSIVE DAMAGE WILL RESULT IF THE AMPLIFIER IS CONNECTED TO THE WRONG SUPPLY VOLTAGE. UNDER NO CIRCUMSTANCES SHOULD THIS SWITCH BE OPERATED WHILE THE SUPPLY IS CONNECTED.

Connect the unit to the mains supply, switch it "on" and observe that the indicator lamp illuminates.

4.2 Gain and Gain Variation (See Figure 3)

Equipment Required:

Oscilloscope	(Tektronix T 921)
Sweep signal generators	(HP8601A, Wavetek 2001)
50Ω video detector	(Wavetek D151)
10 dB 75W attenuator	(EMCO)

Procedure:

a. Set up the test equipment as shown in Figure 3.

b. Set the oscilloscope to DC, time/cm to ext. X, and vertical gain to 10 mV/cm.

c. Set the sweep generator to the S/S mode with the start frequency at 1 MHz and the stop frequency at 150 MHz.

d. Disconnect the Model 325LA from the set-up and connect the sweeper/ generator RF output directly to the 10 dB attenuator.

e. Adjust the output level of the sweeper/generator for full vertical deflection of the oscilloscope face.

f. Calibrate the scope face to shown 3 dB in 1 dB steps and mark the traces with a grease pencil.

g. Return the sweep/generator output level to full deflection. Rotate the step attenuator on the sweep/generator (CCW) so that the output is reduced by 50 dB.

h. Reconnect the Model 325LA into the test set-up of Figure 3.

i. Turn on the Model 325LA power switch.

j. Observe the gain versus frequency sweep on the oscilloscope.

k. The average gain should be 50 dB (within 2 dB).

l. The gain variation should be within the 3 dB markings as shown on the oscilloscope face.

m. Repeat steps (a) through (h) using the HP8601 sweep/generator with start and stop frequencies at 250 kHz and 1 MHz respectively.

4.3 RF Output Power Test (See Figure 4)

The purpose of this test it to verify that the Model 325LA will deliver its rated power over the frequency range to 0.25 MHz to 150 MHz.

Equipment Required:

Signal generator	(HP 8601A; Wavetek 2001)
Power Meter	(HP 435B, 8482B power sensor with matching 30 dB attenuator)
Attenuator	10 dB 75W (EMCO)

Procedure:

a. Set-up the test equipment as shown in Figure 4.

b. Set the power meter to the 10W range. With the 10 dB series attenuator, this corresponds to a full scale deflection of 100W.

c. Set the Sweep/Generator Wavetek Model 2001 to the CW mode, level to + 10 dBm and frequency to 150 MHz.

d. Slowly decrease frequency while observing the power meter. Note that at every frequency down to 1.0 MHz the power output is greater than 25W.

e. Using the HP model 8601A Sweep/Generator in the CW mode, level at + 10 dBm, frequency set at 1 MHz, slowly decrease frequency while observing the power meter. Note that at every frequency down to 250 kHz the power output is greater than 25W.

4.4 RF Output Distortion Test (See Figure 5)

The purpose of this test is to verify that the harmonic distortion of the Model 325LA and hence its linearity within specified limits.

Equipment required:

Signal generator	(HP 8601A, Wavetex 2001)
Power meter	(HP 435B, 8482B power sensor with matching 30 dB attenuator)
Spectrum analyzer	(HP 140T display unit, 8554L RF section, 8552A if section)
Attenuator	(10 dB 75 W EMCO, 30 dB 200 W Bird 8322)

Procedure:

a. Set-up the test equipment as shown in Figure 5.

b. Set the power meter to 3W range. With the 10 dB series attenuator, this corresponds to a full scale deflection of 30W.

c. Set the Generator/Sweeper to CW and frequency to 150 MHz.

d. Adjust the Generator/Sweeper to output level so that the output power indicated on the power meter is 20W.

e. Disconnect the cable from the power meter and connect to the Spectrum Analyzer through a 30 dB attenuator.

f. Observe that all harmonics are at least 23 dB below the fundamental.

g. Repeat steps a. through f. with the generator set at 10 MHz, 30 MHz, 80 MHz, 110 MHz, and 130 MHz, in succession.

h. Repeat steps a. through f. with HP model 8601A Sweep/Generator set at 250 kHz.

4.5 Troubleshooting

If the Model 325LA should fail to operate, and the panel light does not glow, check the condition of the fuse at the rear of the unit (4ASB 313004).

If the unit cycles on and off over a period of time, check the conditions of the fan filter (see maintenance instructions, section 4.6).

The Model 325LA circuit modules should be serviced only by the factory or its authorized facility. However, ENI will supply pre-aligned and calibrated module boards as replacement items.

DO NOT ATTEMPT to probe the circuit modules while they are mounted in the amplifier case, as extensive damage may result.

When factory service is required, the following steps should be taken:

1) Notify ENI, giving full details of the difficulty. include the instrument's serial number.

2) Upon receipt of shipping instructions, forward the instrument, transportation prepaid, to the factory or to the authorized repair station indicated on the instructions.

An estimate of the charge will be made before the work begins, provided the instrument is not covered by the warranty.

4.6 Maintenance

There are no periodic electrical adjustments required to maintain the amplifier gain and power output characteristics.

Periodic cleaning of the fan filter should be performed every six months under ordinary service conditions.

To remove the filter, unscrew the four #6-32 cap nuts on the rear panel and gently pry off the filter.

The filter may be cleaned with compressed air or soaked in an industrial cleaner such as toluene for a few minutes. After drying thoroughly, reassemble the filter on the rear panel using the removed hardware.

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325LA Specifications

Frequency Coverage:	250 kHz to 150 MHz
Gain:	50 dB Nominal
Gain Variation:	+1.5 dB
Maximum Class A Linear Output:	25W
Harmonic Distortion:	All harmonics more than 23 dB below main signal at 20W output. Lower at reduced power output.
Typical 3rd Order Intermodulation Intercept Point:	+53 dBm
Input/Output Impedance:	50Ω
Input VSWR:	Less than 1.5
Output VSWR:	Less than 2.5
Noise Figure:	10 dB Maximum
Stability:	Unconditionally stable; unit will not oscillate for any condition of load and source impedance.
Protection:	Unit will withstand more than 13 dB of over (input signal of 1V RMS) for all output load conditions.
Output Metering:	Average reading voltmeter calibrated in RMS volts for a sine wave with an accuracy of +4% of full scale 0-50V; also calibrated in Watts into 50Ω (0-50W).
Power Requirements:	115/230 VAC; +8%, 50-60 Hz, 280W

325LA Specifications Continued

Operating Temperature:	0° to 45° C
Size:	7.5h x 9.5w x 12.5d in. 19.1 x 24.1 x 31.8 cm.
Weight:	25 lbs; 11.3 kg.
Connectors:	BNC
Rack Mounting:	Adaptors Provided

325LA Front View

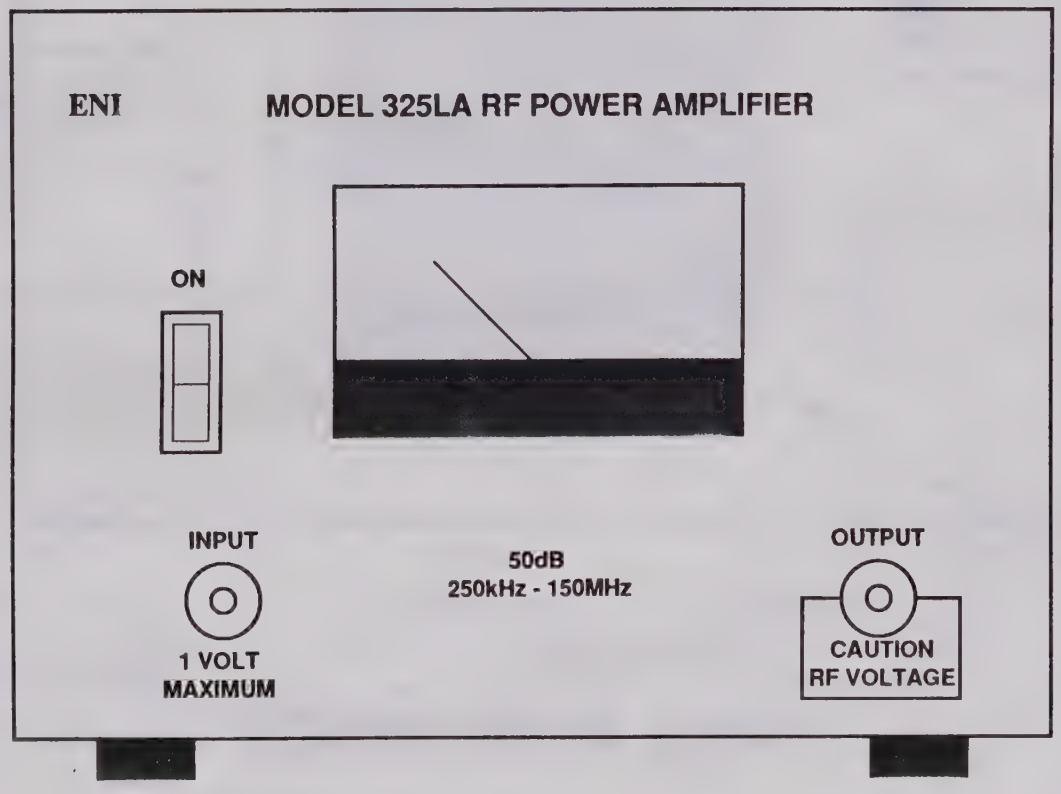
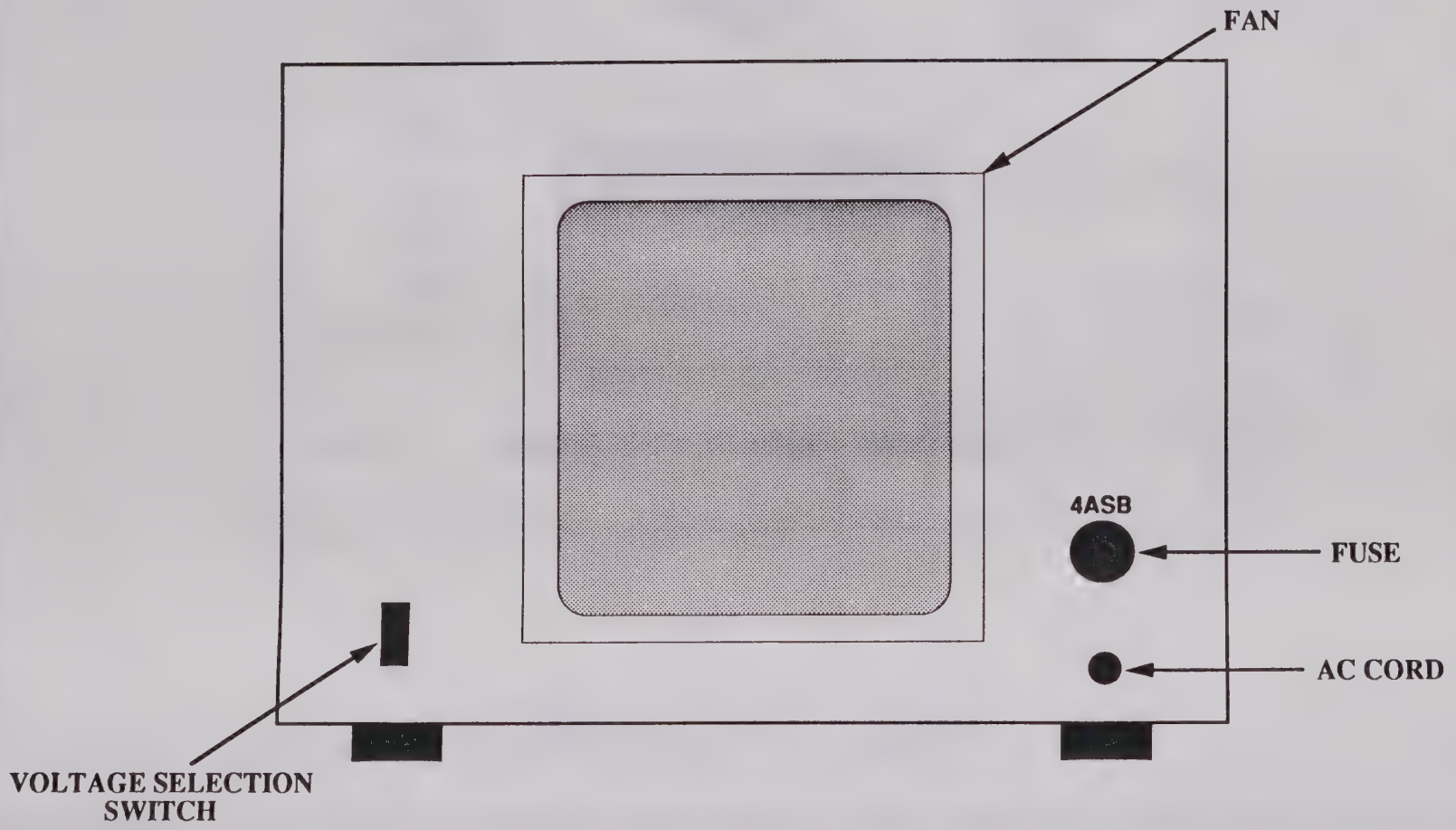


Figure 2

325LA Rear View



Gain & Gain Variation Test Set-Up

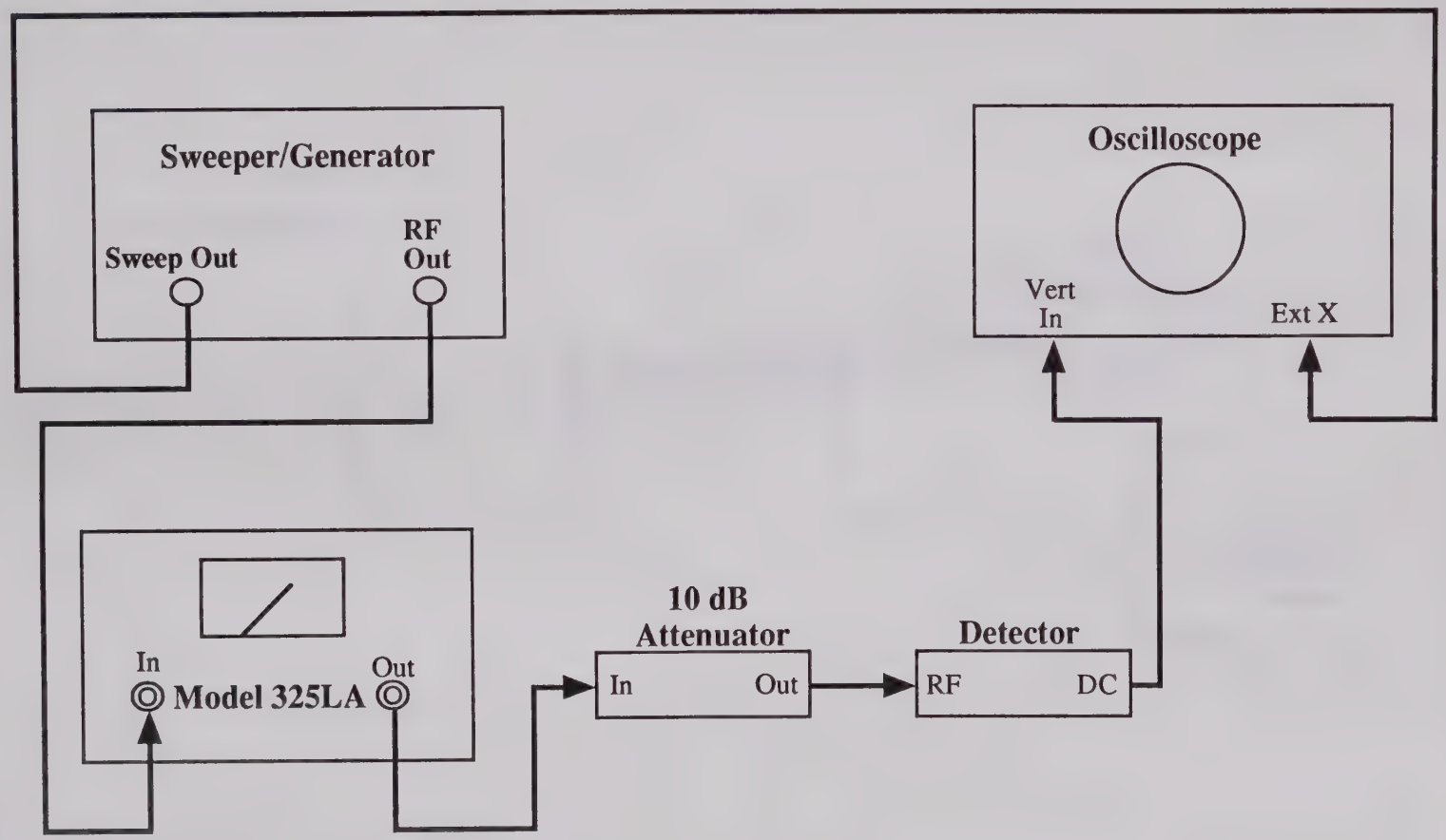


Figure 3

Figure 4

RF Output Power Test Set-Up

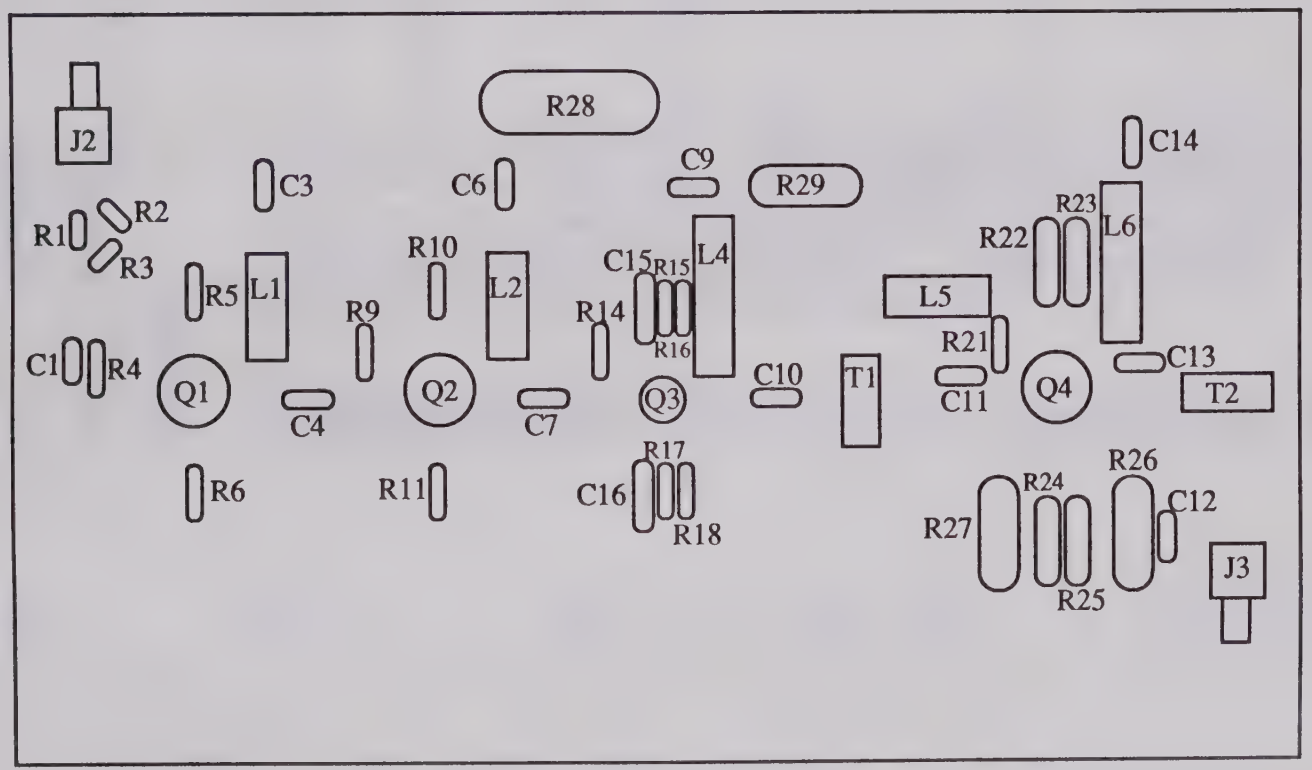
Figure 5

RF Output Distortion Test Set-Up

Layout drawings and parts list

A.	Driver Amplifier Board	(325LA-14512)	33
B.	RF Voltmeter Board	(325LA-14513)	37
C.	Power Amplifier Board	(3325LA-14515)	39
D.	PS/Series Regulator Board	(325LA-14516)	43
E.	Other Parts		45

Driver Amplifier Board (325LA-14512) Layout



325LA Driver Amplifier Board (325LA-14512)

Resistors:

Code	Description	ENI #
R1	18Ω, 0.125W, 5%	180002
R2	300Ω, 0.125W, 5%	180010
R3	300Ω, 0.125W, 5%	180010
R4	560Ω, 0.25W, 5%	140030
R5	27Ω, 0.25W, 5%	140008
R6	27Ω, 0.25W, 5%	140008
R7	3kΩ, 0.25W, 5%	140044
R8	240Ω, 0.25W, 5%	140023
R9	390Ω, 0.25W, 5%	140028
R10	39Ω, 0.25W, 5%	140011
R11	39Ω, 0.25W, 5%	1400
R12	2kΩ, 0.25W, 5%	140040
R13	240Ω, 0.25W, 5%	140023
R14	470Ω, 0.25W, 5%	140029
R15	62Ω, 0.25W, 5%	140014
R16	62Ω, 0.25W, 5%	140014
R17	62Ω, 0.25W, 5%	140014
R18	62Ω, 0.25W, 5%	140014
R19	2kΩ, 0.25W, 5%	140040
R20	200Ω, 0.25W, 5%	140022
R21	75Ω, 0.50W, 5%	120036
R22	24Ω, 1W, 5%	1000004
R23	24Ω, 1W, 5%	1000004
R24	24Ω, 1W, 5%	1000004
R25	24Ω, 1W, 5%	1000004
R26	360kΩ, 2W, 5%	2000032
R27	200Ω, 2W, 5%	2000016
R28	82Ω, 3W, 5%	3000001

Capacitors :

Code	Description	ENI #
C1	0.1µF, 50V	10065
C2	0.033µF, 50V	10063
C3	0.47µF, 50V	10066
C4	0.1µF, 50V	10065
C5	0.033µF, 50V	10063
C6	0.47µF, 50V	10066

Code	Description	ENI #
C7	0.1µF, 50V	10065
C8	0.033µF, 50V	10063
C9	0.47µF, 50V	10066
C10	0.1µF, 50V	10065
C11	0.47µF, 50V	10066
C12	0.1µF, 50V	10065
C13	0.47µF, 50V	10066
C14	0.47µF, 50V	10066
C15	10pF	10069
C16	10pF	10069

Chokes:

L1	150mH	10149
L2	150mH	10149
L3	0.27mH	10135
L4	100mH	10148
L5	150mH	10149
L6	27mH	10146

Transformers:

T1	'A' Core	10222
T2	'A' Core	10222

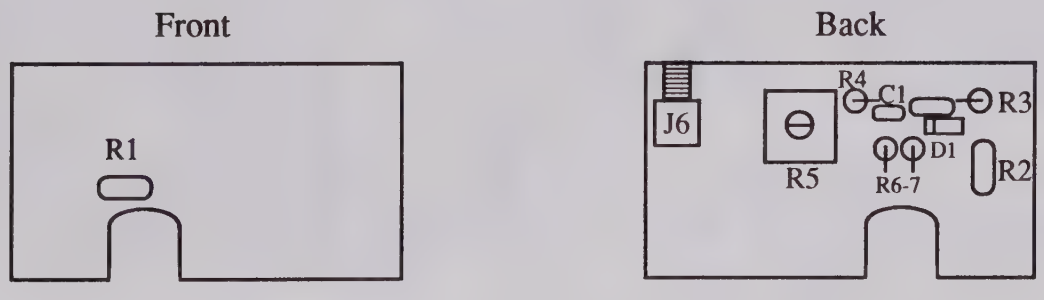
Transistors:

Q1		10679
Q2		10679
Q3		10680
Q4		10786

Miscellaneous:

A-250c	P.C. Board	11148
J2	Connector	10210
J4	Connector	10210

RF Voltmeter Board (325LA-14513) Layout



325LA RF Voltmeter Board (325LA-14513)

Resistors:

Code	Description	ENI #
R1	3.6kΩ, 0.50W, 5%	120044
R2	3.6kΩ, 0.50W, 5%	120044
R3	1kΩ, 0.25W, 5%	140035
R4	3kΩ, 0.25W, 5%	140044
R5	Potentiometer, 1kΩ	10411
R6	22Ω, 0.25W, 5%	140007
R7	3kΩ, 0.25W, 5%	140044

Capacitors :

Code	Description	ENI #
C1	0.1mF, 50V	10065

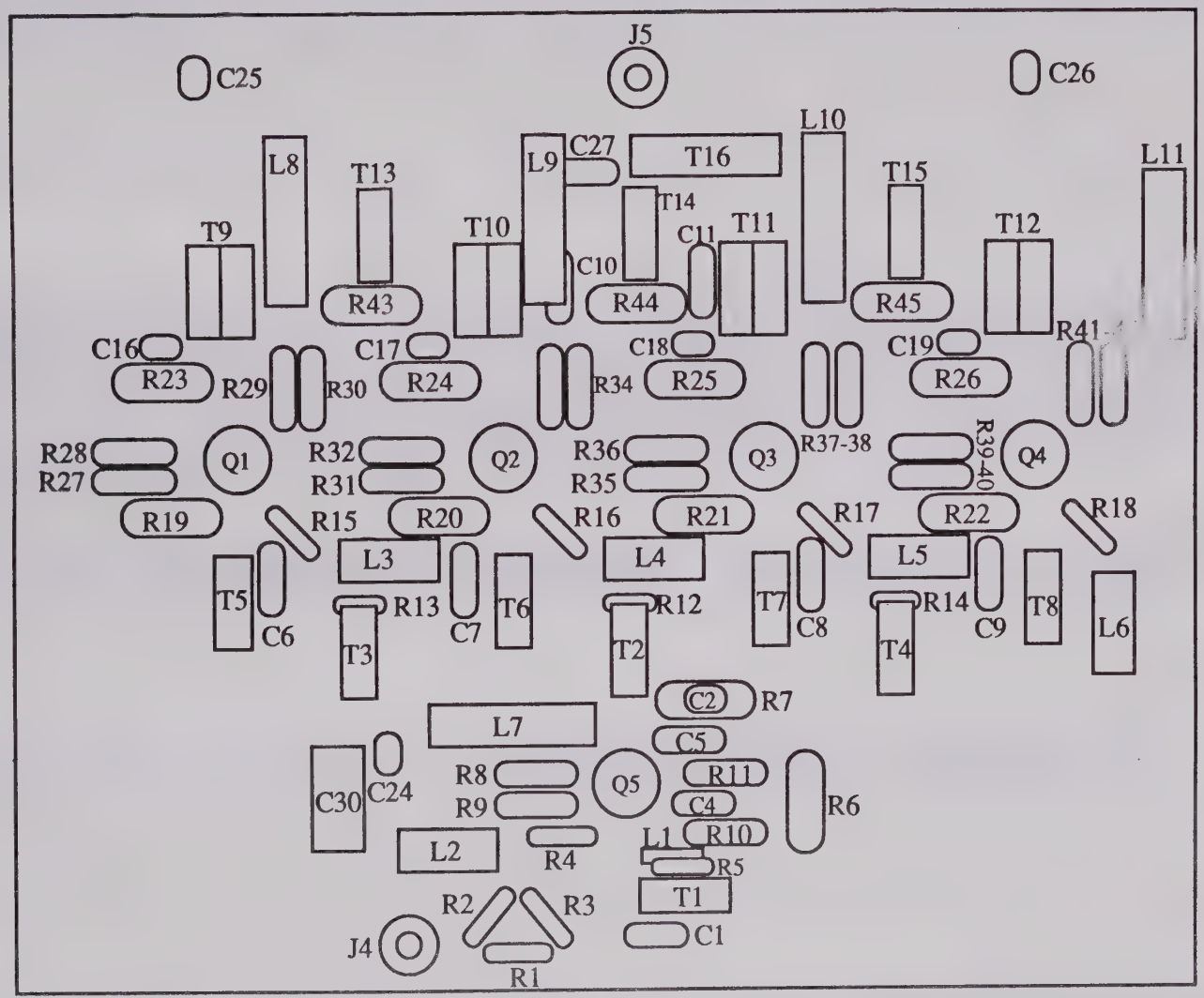
Diodes:

D1		10250

Miscellaneous :

A-251a	P.C. Board	11146
J6	Connector	10210

Power Amplifier Board (325LA-14515) Layout



325LA Power Amplifier Board (325LA-14515)

Resistors:

Code	Description	ENI #
R1	12Ω, 0.50W, 5%	120002
R2	390Ω, 0.50W, 5%	120017
R3	390Ω, 0.50W, 5%	120017
R4	75Ω, 0.50W, 5%	120036
R5	120Ω, 0.25W, 5%	140019
R8	12Ω, 1W, 5%	1000003
R9	12Ω, 1W, 5%	1000003
R10	12Ω, 1W, 5%	1000003
R11	12Ω, 1W, 5%	1000003
R12	51Ω, 0.50W, 5%	120007
R13	120Ω, 0.25W, 5%	140019
R14	120Ω, 0.25W, 5%	140019
R15	75Ω, 0.50W, 5%	120036
R16	75Ω, 0.50W, 5%	120036
R17	75Ω, 0.50W, 5%	120036
R18	75Ω, 0.50W, 5%	120036
R19	68Ω, 2W, 5%	2000011
R20	68Ω, 2W, 5%	2000011
R21	68Ω, 2W, 5%	2000011
R22	68Ω, 2W, 5%	2000011
R23	360Ω, 2W, 5%	2000032
R24	360Ω, 2W, 5%	2000032
R25	360Ω, 2W, 5%	2000032
R26	360Ω, 2W, 5%	2000032
R27	10Ω,1W, 5%	1000002
R28	10Ω,1W, 5%	1000002
R29	10Ω,1W, 5%	1000002
R30	10Ω,1W, 5%	1000002
R31	10Ω,1W, 5%	1000002
R32	10Ω,1W, 5%	1000002
R33	10Ω,1W, 5%	1000002
R34	10Ω,1W, 5%	1000002
R35	10Ω,1W, 5%	1000002
R36	10Ω,1W, 5%	1000002
R37	10Ω,1W, 5%	1000002
R38	10Ω,1W, 5%	1000002
R39	10Ω,1W, 5%	1000002
R40	10Ω,1W, 5%	1000002
R41	10Ω,1W, 5%	1000002
R42	10Ω,1W, 5%	1000002

Code	Description	ENI #
R44	51Ω, 2W, 5%	2000010
R43	120Ω, 2W, 5%	2000014
R45	120Ω, 2W, 5%	2000014

Capacitors :

C1	5pF	10068
C2	0.1µF, 50V	10065
C4	150pF	10086
C5	27pF	10075
C6	10pF	10069
C7	10pF	10069
C8	10pF	10069
C9	10pF	10069
C10	15pF	10071
C11	15pF	10071
C16	0.1µF, 50V	10065
C17	0.1µF, 50V	10065
C18	0.1µF, 50V	10065
C19	0.1µF, 50V	10065
C12	0.47µF	10066
C13	0.47µF	10066
C14	0.47µF	10066
C26	0.47µF	10066
C27	33pF	10077
C30	50mF, 50V	10108

Chokes:

L1	0.15mHy	10132
L2	150mHy	10149
L3	150mHy	10149
L4	150mHy	10149
L5	150mHy	10149
L6	150mHy	10149
L7	27mHy	10146
L8	27mHy	10146
L9	27mHy	10146
L10	27mHy	10146
L11	27mHy	10146

Transformers:

Code	Description	ENI #
T1	'A' Core	10222
T2	'A' Core	10222
T3	'A' Core	10222
T4	'A' Core	10222
T5	'A' Core	10222
T6	'A' Core	10222
T7	'A' Core	10222
T8	'A' Core	10222
T9	'A' Core	10222
T10	'A' Core	10222
T11	'A' Core	10222
T12	'A' Core	10222
T13	'A' Core	10222
T14	'A' Core	10222
T15	'A' Core	10222
T16	'C' Core	10224

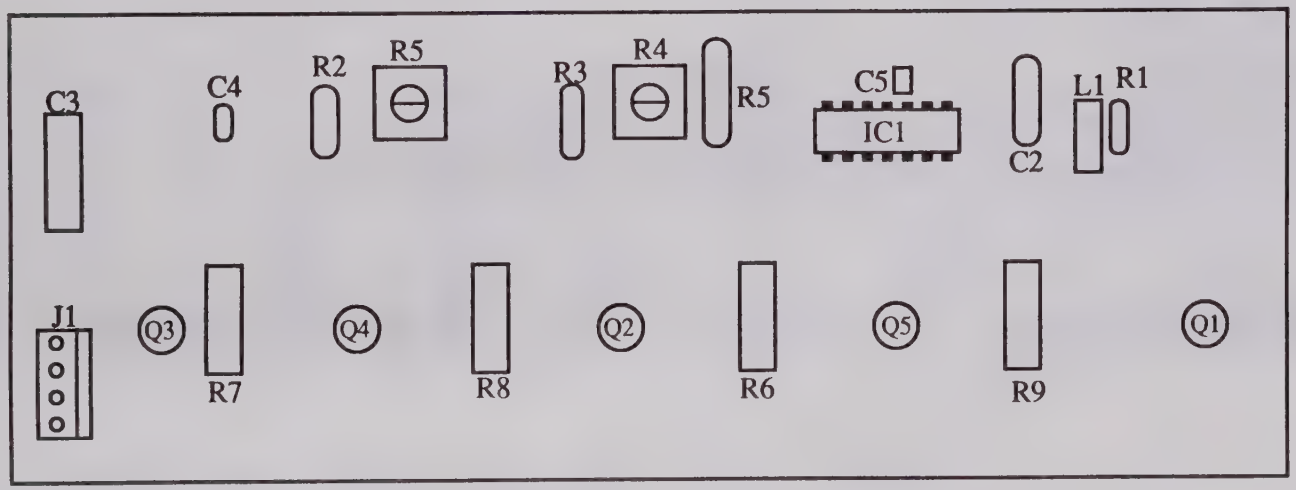
Transistors:

Q1		10786
Q2		10786
Q3		10786
Q4		10786
Q5		10786

Miscellaneous :

A-166D	P.C. Board	10815
J4	Connector	10217
J5	Connector	10217

PS/Series Regulator Board (325LA-14516) Layout



325LA PS/Series Regulator Board (325LA-14516)

Resistors:

Code	Description	ENI #
R1	47kΩ, 0.25W, 5%	140064
R2	2.7kΩ, 0.50W, 1%	10569
R3	7.5kΩ, 0.50W, 2%	10572
R4	Potentiometer, 200Ω	10408
R5	Potentiometer, 200Ω	10408
R6	51Ω, 2W	10583
R7	51Ω, 2W	10583
R8	51Ω, 2W	10583
R9	51Ω, 2W	10583

Capacitors :

C1	560pF	10093
C2	150pF	10086
C3	50mF, 50V	10108
C4	0.1mF, 50V	10065
C5	Chip, 68pF	10805

Chokes:

L1	0.47µhy	10137

Integrated Circuits:

IC1		11042

Transistors:

Q1		10684
Q2		10684
Q3		10684
Q4		10684
Q5		10684

Miscellaneous:

A-249d	P.C. Board	11147
	Transistor Socket	11324
	Connector, MTA 4pin	11802
	Connector, 14 pin Dip	10912

325LA Other Parts

Metal Parts:

Code	*Description*	*ENI #*
240L-012-1	Rear Corner Bracket	
240L-012-2	Rear Corner Bracket	
310L-008	Side Bracket	
325LA-001	Baseplate	
325LA-005	P.A. Heatsink	
325LA-006	Bottom Bracket	
325LA-012	Cover	
325LA-013	Rack Mtg. Panel	
325LA-208	PS/Driver Heatsink	
	Handle	10305
	Fuse Guard	10265

Components and Electrical Parts:

Code	*Description*	*ENI #*
T1	Transformer	671007
CR1	Bridge Rectifier	10003
B1	Fan	10259
C1	Capacitor 12000pF, 40V	10115
	Relay, 120VAC	10539
	Bulb	10333
	Fuse 4amp SB	10287

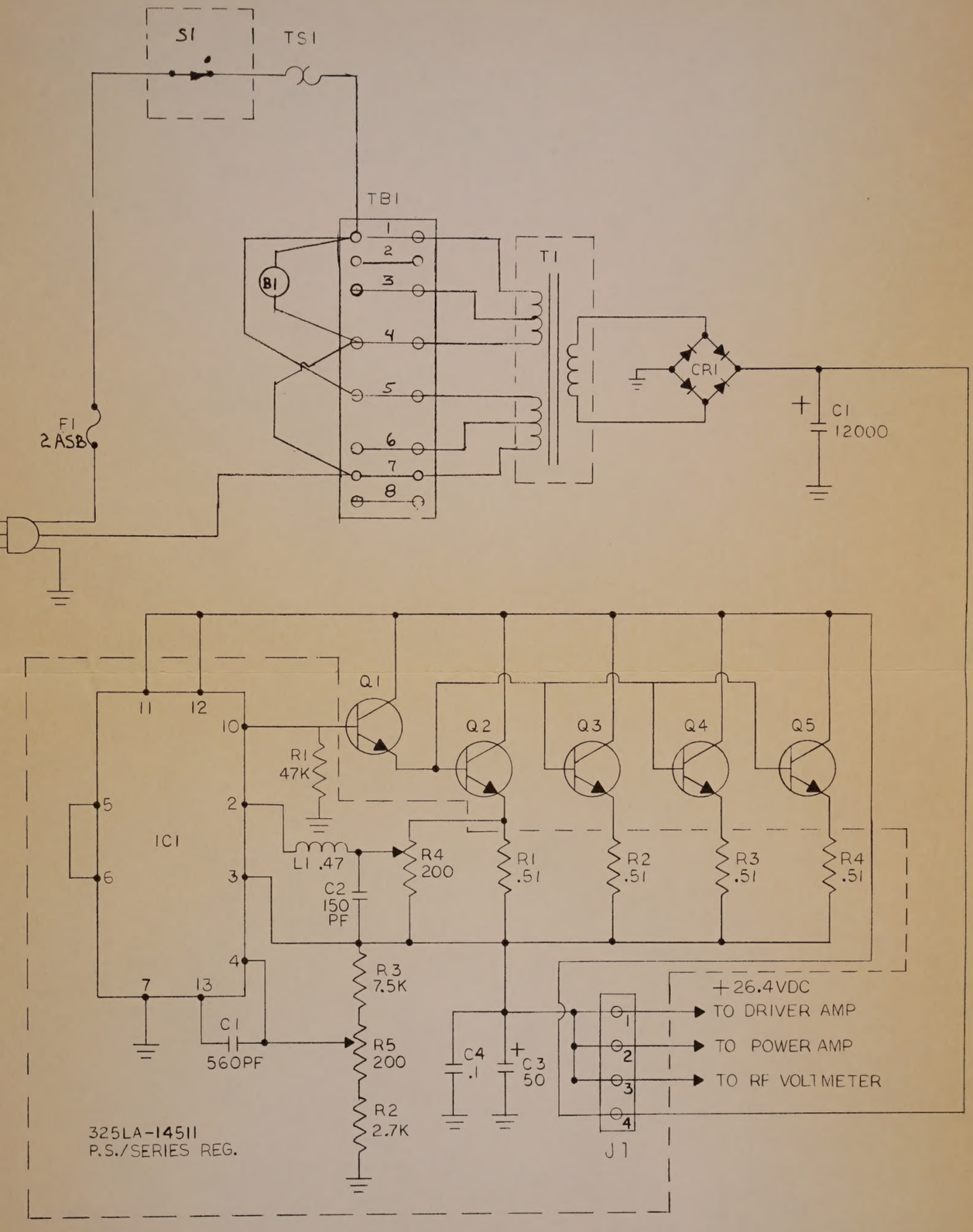
Cables and Miscellaneous:

Code	*Description*	*ENI #*
	Feet	10276
	Capacitor Clamp	10127
TB1	Terminal Block	10648
	Marker Strip	10652
	Connector	10838
	Connector	10839
J1,7	Connector	10176
	Connector	10217
	Connector 4 pin MTA	11803

Code	*Description*	*ENI #*
S1	Switch	10626
	Linecord 18/3	10341
	Linecord Clamp	10347
	Fuse Holder	10298
TS1	Switch	10634

Glossary of abbreviations

A	Amperes
AMP	Amperes
ASSY	Assembly
BR	Bridge
CAP	Capacitor
CER	Ceramic
DESIG	Designation
ELECT	Electrolytic
IC	Integrated Circuit
K	Kilohms
kΩ	Kilohms
mV	Millivolts
pF	Picofarad
PIV	Peak Inverse Power
POT	Potentiometer
REF	Reference
REQ	Required
RES	Resistor
S.B.	Slow Blow
uF	Microfarad
μF	Microfarad
uH	Microhenry
μH	Microhenry
V	Volts
VDCW	DC Working Voltage
W	Watts
WW	Wire Wound



REV B ECN 1464 12-22-88
LAST ECN 1246 12-22-87

FIGURE 5-2.
POWER DISTRIBUTION SCHEMATIC DIAGRAM

43957